

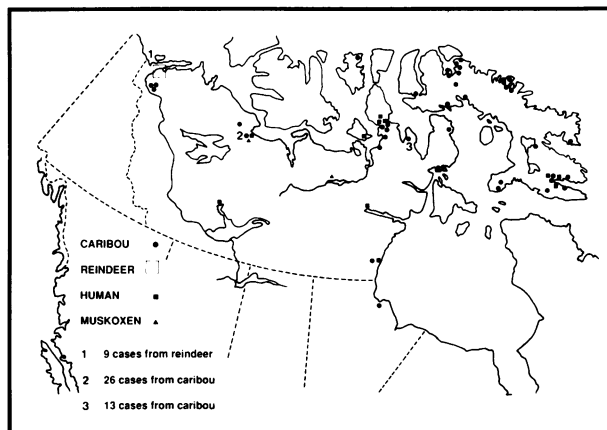
# Isolates of *Brucella suis* biovar 4 from animals and humans in Canada, 1982–1990

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*Brucella suis* biovar 4 is the causative agent of brucellosis in reindeer and caribou (*Rangifer tarandus* subsp.). Clinical signs, when present in these species, can include abortion, stillbirth, weak calves, orchitis, epididymitis, enlarged joints, lameness, and abscesses or granulomas in various locations including subcutaneous tissue, reproductive organs, and mammary gland (1). Renal involvement has been described (2,3). The frequency and duration of lesions and clinical signs under natural conditions are unknown. The transmission and maintenance of rangiferine brucellosis within a population are assumed to be similar to bovine brucellosis caused by *Brucella abortus*. It is thought that large numbers of brucellae are disseminated into the environment at parturition, at which time orally exposed animals become infected (1,4). Although group fawning over a short period of time under cool climatic conditions is optimal for transmission, it is not known what proportion of infected females shed the organism at parturition. The significance of venereal exposure or oral exposure via milk is unknown, and vertical transmission has not been studied. Animals cohabiting range or utilizing reindeer or caribou as sources of food can be infected. Natural or experimental infection has been described in wolves, bears, foxes, humans, a muskox, and various species of rodents (5–9).

In the past, rangiferine brucellosis was not considered a threat to domestic livestock because the disease was geographically isolated from agricultural areas. However, the advent of game ranching as an alternative form of meat production has placed pressure on regulatory agencies to allow movement of nontraditional species into traditional agricultural zones. The effect of *B. suis* biovar 4 on domestic livestock, game ranching species such as bison, elk, and red deer, and free ranging wildlife in southern Canada, is unknown. A few limited studies have been done, but results were either inconclusive or based on circumstantial evidence (4,10,11). Additional data on rangiferine brucellosis in both the normal host and contact species are required. Some information is immediately available from existing diagnostic databases. I summarize herein 100 cases of *B. suis* biovar 4 either identified or confirmed at the Health of Animals Laboratory, Saskatoon (HAL/Sask), between July, 1982, and October, 1990. Seven cases previously reported are included (2,8).

*Brucella suis* biovar 4 was recovered from 78 caribou, 11 humans, nine reindeer, and two muskoxen. The case submissions were not derived from a



**Figure 1.** Map of northern Canada showing the location of 99 cases of *Brucella suis* biovar 4 confirmed bacteriologically. Cases in caribou, human beings, muskoxen, and reindeer are represented by circles, squares, stars, and a triangle, respectively. Solid symbols indicate single cases. Open symbols represent multiple cases in the surrounding area, and contain an arabic numeral indicating totals. All caribou are barren-ground caribou unless otherwise stated.

random sampling; therefore, the positive cases do not necessarily reflect disease incidence in each species or in northern Canada as a whole. The majority of specimens from caribou were submitted because of clinical signs or gross lesions. The human cases were all from clinically ill native people utilizing caribou as part of their diet. The nine culture-positive reindeer were sampled because they were serological reactors to *Brucella* antigen, not because of clinical signs. They were part of a group of reindeer from the Tuktoyaktuk area that were transported to Dawson Creek, British Columbia, for game farming purposes. The two cases of *B. suis* biovar 4 in muskoxen had lesions. The cases in muskox are important because they demonstrate crossover from cervidae to bovidae, the latter being the family that includes domestic cattle, sheep, goats, and bison.

Figure 1 shows the distribution of 99 of the 100 confirmed cases of *B. suis* biovar 4 in northern Canada (the location of origin of one case was unknown). All major barren-ground caribou (*R.t. groenlandicus*) herds from Alaska to Baffin Island, and the reindeer (*R.t. tarandus*) herd at Tuktoyaktuk are infected. A single case of *B. suis* biovar 4 was identified in a Peary caribou (*R.t. pearyi*) from Back Bay, Prince of Wales Island, Northwest Territories from samples submitted by M. Ferguson, Department of Renewable Resources, Northwest Territories. There are no published data to indicate the status of isolated herds of Peary caribou on other northern arctic islands or woodland caribou (*R.t. caribou*) in the south. The case files of the HAL/Sask contain reports on four woodland caribou from the Nyarling River area,

**Table 1. Summary of tissues from which *B. suis* biovar 4 was isolated<sup>a</sup>**

Tissue	Gross lesion		Not described	Total	Species
	Suppurative <sup>b</sup>	Nonsuppurative			
Carpal joint	9	12	9	30	29 caribou, 1 muskox
Lymph nodes	2	28		30	7 caribou, 23 reindeer
Testicle	15	1	5	21	18 caribou, 2 reindeer, 1 muskox
Joints other than carpus	7	2	6	15	14 caribou, 1 human
Blood		10		10	All human
Subcutaneous abscess	9			9	All caribou
Mammary gland	4	3		7	6 reindeer, 1 caribou
Epididymis	4		1	5	All caribou
Abscessed muscle	3			3	All caribou
Liver	1		2	3	All caribou
Kidney	1			1	Caribou
Uterus			1	1	Caribou
Placenta		1		1	Caribou
Abscess of rumen wall	1			1	Caribou

<sup>a</sup>One hundred culture-positive cases of caribou, reindeer, muskox, and human origin. Some cases had more than one positive tissue

<sup>b</sup>Classed as suppurative if any of the following terms were used in describing the lesion: abscess, pus, purulent, suppurative

Northwest Territories, all of which were culture-negative for *Brucella* spp. The distribution of positive cases agrees with an earlier report which concluded that *B. suis* biovar 4 is enzootic in most Canadian barren-ground caribou herds (2). There is no bacteriological evidence of rangiferine brucellosis east of Hudson Bay. An anti-*Brucella* titer of  $\geq 1:8$  on a slide agglutination test was reported in a human from Fort Chimo, Quebec, in 1958 (12). This finding was part of a serological survey for a variety of diseases and was not followed up or confirmed bacteriologically. Twelve of 40 serum samples collected from caribou in 1987 from the Nain region, Labrador, were positive on the buffered plate antigen screening test (BPAT) for brucellosis, but were negative on confirmatory complement fixation and enzyme immunoassay tests. From the same area in 1988, serum samples from 11 caribou were negative on both the BPAT and the standard tube agglutination test. One to three lymph nodes from an additional 25 caribou were included in the 1988 sampling and were negative on bacteriology. These data are from test reports on file at the Animal Diseases Research Institute, Nepean, Ontario, or HAL/Sask. Test procedures were described previously (13). Further work is necessary to define the status of the caribou herds east of Hudson Bay.

Table 1 lists the number of *B. suis* biovar 4 isolations from various tissue types, and the animal species involved. The number of animals found positive by species was related to the number of case submissions by species. Seventy-seven percent of the 253 case submissions in the database were from caribou. These accounted for 78 of the 100 positive cases. Similarly, reindeer and muskoxen, which comprised 13% and 6% of the data base, respectively, accounted for 9% and 2% of the positive cases, respectively. The cultural examination of 640 specimens from the 253 cases resulted in 137 isolations from the 100 positive cases. The number of tissues received per case ranged from 1–22, but averaged only 2.5. Therefore, information on tissue distribution patterns of *B. suis* biovar 4,

based on isolations from individual animals, is minimal.

Twenty-four percent of the 640 tissues submitted for culture were from joints and testes, and these yielded 52% of the total isolations. In contrast, lymph nodes comprised a larger proportion of submissions (39%), but a smaller proportion of isolations (22%). This does not necessarily mean that testes and joints are the preferred sites for localization by the organism. Lymph nodes seldom show visible lesions, and some are difficult to observe and collect because of their anatomical location. Anything less than a complete sampling of all major body nodes could result in infected nodes being missed. Testes and joints, in contrast, are readily visible and relatively easy to sample. They often exhibit gross abnormalities when infected with *B. suis* biovar 4. Under field conditions these infected tissues are more likely to be collected than either infected joints and testes which appear normal, or infected lymph nodes. This may account for the high isolation rate from joints and testes seen in this database.

Only 3% of total submissions were from mammary tissue, uterus, or placenta, but these comprised 7% of the isolates. This disproportionately high rate of isolation is difficult to assess because of the low number of submissions (20 of 640 tissues). However, based on knowledge of brucellosis in other species it may be expected, but not assumed, that isolation frequencies from mammary gland, uterus, and placenta would be high in caribou and reindeer, particularly in late pregnancy and immediately following parturition. The three isolations from liver have zoonotic implications for people who traditionally consume raw animal products.

The data in Table 1 support existing evidence that indicates *B. suis* biovar 4 localizes in a variety of tissues. The extent of involvement in individual animals, however, cannot be extrapolated from these data.

The available data on rangiferine brucellosis are incomplete. Information on the susceptibility of

domestic animals, game ranched species, and free ranging wildlife to infection with *B. suis* biovar 4 is an immediate priority. The geographical distribution of rangiferine brucellosis in the Canadian north needs to be determined, and brucellosis-free herds, if present, need to be identified. The serological tests for brucellosis in cattle use *B. abortus* antigens; the same antigens are used to detect *B. suis* biovar 4 infection in reindeer and caribou. Although these tests identify infected animals, their actual sensitivity and specificity for rangiferine brucellosis need to be determined. Additional data on tissue distribution of the organism, particularly at different stages of the female reproductive cycle, are necessary to understand disease maintenance in the host, and to identify all routes of excretion that could be significant in transmission. Research will be necessary to answer these questions.

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